INSTRUCTIONS

PRELIMINARY GEK-22956-A

DC-3032R

MACHINE TOOL DRIVE
(FEED)

OPERATION AND MAINTENANCE
MANUAL

GENERAL ELECTRIC

SIMPLIFIED START-UP AND CHECKOUT PROCEDURE (FOR FEED DRIVES WITH DIAGNOSTIC FUNCTION)

IF ANY DIFFICULTIES ARE ENCOUNTERED DURING START-UP AND CHECKOUT, REFER TO SECTION 4 OF INSTRUCTION BOOK FOR DETAILED START-UP AND CHECKOUT PROCEDURE.

WARNING

ELECTRIC SHOCK CAN CAUSE PERSONAL INJURY OR LOSS OF LIFE. WHETHER THE AC SUPPLY IS GROUNDED OR NOT, HIGH VOLTAGES TO GROUND WILL BE PRESENT AT MANY POINTS THROUGHOUT THE DRIVE.

1. VERIFY THAT THE 3-PHASE AC POWER INPUT TO THE DRIVE IS OF THE PROPER VALUE/FREQUENCY AS LISTED ON THE EQUIPMENT DATA NAMEPLATE (–5, +10%).

2. SET TEST REFERENCE POTENTIOMETER TO ZERO, SWITCH No. 1 TO CENTER, SWITCH No. 2 TO CENTER; THIS DISCONNECTS POWER FROM SCR MODULE AND DISCONNECTS ALL REFERENCE INPUTS.

3. APPLY MAIN AC POWER TO THE DRIVE SYSTEM. THE PHASE SEQUENCE INDICATOR ILLUMINATES (THE AC CIRCUIT BREAKER IN THE DRIVE SYSTEM MUST BE SWITCHED ON). THIS INDICATOR WHEN ILLUMINATED INDICATES THE FOLLOWING:

   A. THREE PHASE POWER IS APPLIED AND IS IN THE PROPER PHASE SEQUENCE.

NOTE

IF THE INDICATOR FAILS TO ILLUMINATE, INTERCHANGE ANY TWO TRANSFORMER INPUT PHASES ONCE: IF INDICATOR IS STILL OUT PROCEED TO THE TROUBLE-SHOOTING TABLE 6–1.

CAUTION

WHEN OPERATING DRIVE IN THE TEST OR MANUAL MODE, CONTINUALLY OBSERVE THE MACHINE TRAVEL TO AVOID HITTING THE ELECTRICAL AND/OR MECHANICAL LIMITS.

4. VERIFY TEST REFERENCE POTENTIOMETER IS SET TO 0, PLACE SWITCH No. 1 TO DOWN AND SWITCH No. 2 TO UP SWITCH POSITION. USE TEST REFERENCE POTENTIOMETER IN CW AND CCW DIRECTION TO VERIFY PROPER MOTOR OPERATION. VERIFY THAT THE TACHOMETER INPUT (TEST REFERENCE IS CW) IS NEGATIVE AT 1TB17.

5. SET TEST REFERENCE POTENTIOMETER TO 0, SWITCH No. 1 TO UP SWITCH POSITION, SWITCH No. 2 TO CENTER; THIS PROVIDES NORMAL SYSTEM OPERATION.

TABLE OF CONTENTS

TABLE OF CONTENTS

SECTION I
GENERAL

1.1 SCOPE OF MANUAL

This instruction manual is structured around a basic system. It is a guide for the installation, check-out and operation of the equipment, furnished with general troubleshooting procedures for the basic system. Any special purpose equipment, as requested on the purchase order, will normally be covered in the schematic drawings included with this package. If special purpose equipment is added to the Troubleshooting or Description of Equipment section, it will be so noted by an asterisk. These instructions do not purport to cover all details or variations in the equipment nor to provide for every possible contingency in connection with the installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the General Electric Company.

1.2 SAFETY, PERSONNEL AND EQUIPMENT

The following paragraphs list some general safety reminders and safety recommendations to be followed when operating this equipment.

Only trained electrical and electronics personnel should install and maintain this equipment. It is dangerous to the untrained or unskilled.

Definition of terms and sign colors:

WARNING: Denotes operating procedures and practices that may result in personal injury or loss of life if not correctly followed.

Color: Black or white lettering on red field.

CAUTION: Denotes operating procedures and practices that, if not strictly observed, will result in damage to, or destruction of, the equipment.

Color: Black lettering on amber field.

NOTE: Denotes an operating procedure or condition that should be highlighted.

Color: Black lettering on white field.

WARNING: HIGH VOLTAGE

ELECTRIC SHOCK CAN CAUSE PERSONAL INJURY OR LOSS OF LIFE. WHETHER THE AC VOLTAGE SUPPLY IS GROUNDED OR NOT, HIGH VOLTAGES TO GROUND WILL BE PRESENT AT MANY POINTS WITHIN THE SCR DRIVE. EXTREME CARE MUST BE EXERCISED IN THE SELECTION AND USE OF TEST INSTRUMENTS. OPERATOR SHOULD NOT STAND ON GROUNDED SURFACES OR BE IN CONTACT WITH GROUND WHEN APPLYING TEST INSTRUMENTS TO TEST POINTS. CONVENTIONAL TEST INSTRUMENTS SHOULD NOT HAVE CHASSIS GROUNDED WHILE TESTS ARE BEING MADE THUS THE CHASSIS CAN BE AT A HIGH VOLTAGE WITH RESPECT TO GROUND DURING TESTING. EXTREME CARE SHOULD BE TAKEN WHILE ATTEMPTING TO ADJUST, TROUBLESHOOT OR MAINTAIN ANY DRIVE SYSTEM DESCRIBED HEREIN.

When working on or near the equipment with power/voltage applied, it is recommended that all metal objects such as rings, watches and tie clasps be removed.

It is highly recommended that all personnel working on this equipment wear rubber soled shoes (insulated).

WARNING

WHEN WORKING AROUND ROTATING EQUIPMENT, DO NOT WEAR ANY LOOSE CLOTHING THAT COULD BECOME CAUGHT IN THE EQUIPMENT.

CAUTION

DO NOT INSERT OR REMOVE PRINTED CIRCUIT CARDS FROM THE EQUIPMENT WHILE POWER IS APPLIED OR OPERATING; THIS CAN DAMAGE THE EQUIPMENT.

NOTE

ALWAYS READ THE COMPLETE SUBSECTION (EXAMPLE 3-2) PRIOR TO ANY TURN-ON OR TROUBLESHOOTING OF THE EQUIPMENT, FOLLOW THE PROCEDURE STEP BY STEP.

READ AND HEED ALL WARNING, CAUTION AND NOTE SIGNS POSTED ON THE EQUIPMENT.

1.3 WARRANTY AND SHIPPING

1.3.1 Warranty Statement

The Company warrants to the Purchaser that the equipment to be delivered hereunder will be free from defects in material or workmanship and will be of the kind and quality designated or specified in the contract.

This warranty shall apply only to defects appearing within one year from the date of shipment by the Company. (For full "Conditions of Sale" and a complete statement of warranty, refer to your contract papers.)

1.3.2 Receipt of Shipment

All equipment is factory inspected before shipment and is shipped in good condition. Any damages or shortages evident when the equipment is received must be immediately reported to the commercial carrier who transported the equipment. If required, assistance may be received from the General Electric Company, Speed Variator Product Department, but when seeking assistance, please use the purchase order number and model number to help us in assisting you.

1.4 RECEIVING, HANDLING AND STORAGE

1.4.1 Receiving

The equipment should be placed under adequate cover immediately upon receipt as packing cases are not suitable for out-of-doors or unprotected storage.

1.4.2 Handling

Smaller power units, wall mounted, can be transported by lift trucks with forks completely under the base. The larger floor mounted power unit bases have two lifting holes on each side, so that a pipe may be slipped through each pair and crane hooks be used to pick up the unit by means of the pipes. The lifting holes on the top of the power unit may also be used for receiving crane hooks. Spreader bars should be used to spread the cables above the cabinet and bumpers should be used wherever hooks or cables may come into contact with the cabinet, to prevent damage to the cabinet metal and painted surfaces. "Lifting Information" tag on units that can receive crane hooks.

1.4.3 Storage

If the equipment is not to be installed immediately, it should be stored in a clean, dry location that is not subject to extreme temperatures. Precautions should be taken to prevent moisture from accumulating in the equipment. The entrance of moisture, dust or dirt during storage or installation is detrimental to the equipment insulation.

In addition, when a control that has been in operation and will be shut down for either a short or extended period of time, it is recommended the environmental conditions be maintained the same as when in operation. Space heaters or equivalent devices should be used to maintain the equipment in its normal operating state (temperature).

SECTION II
SYSTEMS EQUIPMENT DESCRIPTION

2.1 EQUIPMENT PURPOSE

The Speed Variator drive is a closed loop, adjustable speed, bidirectional, constant horsepower or torque range system designed for coordinated lines, machine tool control and test stand systems. The system consists of three basic blocks:

1. DC Motor
2. Power and Control Unit
3. Transformer

2.2 EQUIPMENT FURNISHED - GENERAL

For the exact description of equipment received, refer to your order data.

2.2.1 DC Motor - 1-5 horsepower, permanent magnet or shunt wound, separately excited field, 120VDC armature, maximum ambient 40°C, thermostat protection, and with d-c tachometer normally supplied.

2.2.2 Power and Control Unit - 230VAC, three phase, 60HZ power input; transformer neutral, SCR three phase, half wave conversion with full regeneration, with output voltage from zero to ±120VDC; open panel, wall or floor mounted enclosures.

2.2.3 Transformer: "isolation" type with secondary point for three phase (three wire) input of 230/460VAC, 60HZ power and output of 230VAC line to line and 133VAC line to neutral.

2.2.4 Special Purpose Equipment - see Elementary Diagrams

2.2.5 Control and Indicator Functions

Table 2-1 will give a listing of the controls and indicators and their function.

TABLE 2-1 FUNCTION OF CONTROLS/INDICATORS

EQUIP/ITEM	CONTROL/INDICATORS	FUNCTIONS
POWER CONVERSION MODULE	Phase sequence indicator light	Illuminates when incoming 3 phase power is on and in correct phase sequence.
FRONT DOOR	Maximum Speed potentiometer	Provides a means of adjusting the speed reference input to obtain top speed.
"DIAGNOSTIC" Function (IDT)	"SWITCH #1" "SWITCH #2"	Two switches are used to select various test conditions or normal running.
	"TEST REFERENCE" potentiometer	Provides a voltage or current source for the test functions.
Circuit Breaker Back Panel Mounted	CB	Applies 3Ø Power, Provides fast interrupt (Trip) for circuit and motor protection for continuous overload, locked rotor and bolted fault conditions.
Motor Thermal Switch		Provides contact closure when motor heating is within safe operating range. Opens when motor temperature exceeds safe range.

2.3 BASIC SYSTEM THEORY OF OPERATION

To understand the theory of operation, first the requirements of the drive system must be stated. The drive system must be able to perform the following:

Convert a-c power to d-c power
Start and stop motor
Control motor speed through range
Sense and correct motor needs (loads)
Protect system
Provide accurate and smooth operation of motor
Monitor and control itself
Provide special acts or needs

The basic system block diagram is shown in Figure 2-1.

The system will be divided into five functional areas; Power, Command and Logic, Driver Regulator, Power Conversion Module and Motor.

2.3.1 Power

Three phase (three wire) a-c power is brought into the transformer (IT) primary. The secondary of the transformer has a fourth leg, neutral (N), for a return current path. The transformer supplies power to the power conversion unit through the circuit breaker and MA contacts for conversion to d-c power. It also supplies power, through the circuit breaker, to the synchronizing transformer assembly (STA). The STA provides synchronization voltage to the driver regulator. The STA also provides power to the d-c power supplies in the regulator. The d-c power supply provides card operating voltages and plus or minus d-c power supply to the command and logic circuitry when required.

2.3.2 Command and Logic

The command logic circuitry (relays, switches and protective devices) is responsible for the starting, stopping, direction, protection and speed reference (REF) input to the system.

2.3.3 Driver Regulator

The driver regulator is composed of five printed circuit cards. Its task is to receive the reference input and coordinate and deliver firing signals to the power conversion module. The driver regulator, after reacting to the command, must then monitor the power conversion module and motor performance, by the way of feedback signals (FDBK) and maintain the input reference request. When the input reference changes, the driver regulator must provide the power conversion module with the new command signal. Refer to Figure 2-2.

2.3 BASIC SYSTEM THEORY OF OPERATION (cont'd.)

2.3.4 Power Conversion Module

The power conversion module consists of a pulse transformer card and six SCR's mounted on heatsink assemblies. The three phase a-c power from the transformer is converted to d-c power by the SCR's and adjusts the voltage applied to the motor. This is accomplished by the driver regulator firing signals acting on the SCR gates at the proper instant in time to allow the motor to meet the request. Also provided are snubber circuitry, a current (DC) detector and a phase sequence indicator.

2.3.5 DC Motor

The motor will react to the amount of voltage and current from the power conversion module providing power across its speed range. The motor field is determined by a static, non-adjustable, exciter, or by internal permanent magnets as applicable.

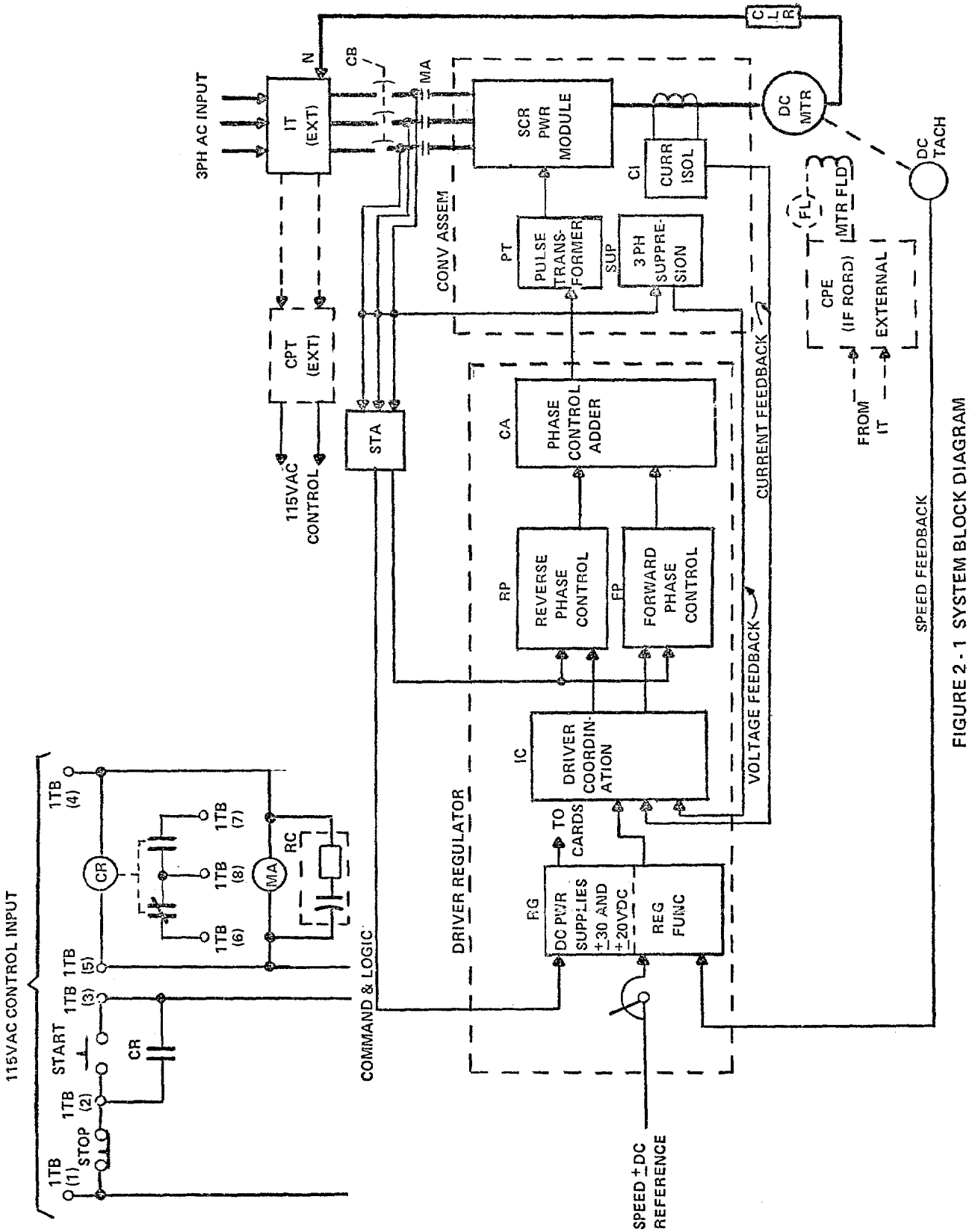


FIGURE 2 - 1 SYSTEM BLOCK DIAGRAM
(DC-3032R SINGLE AXIS)

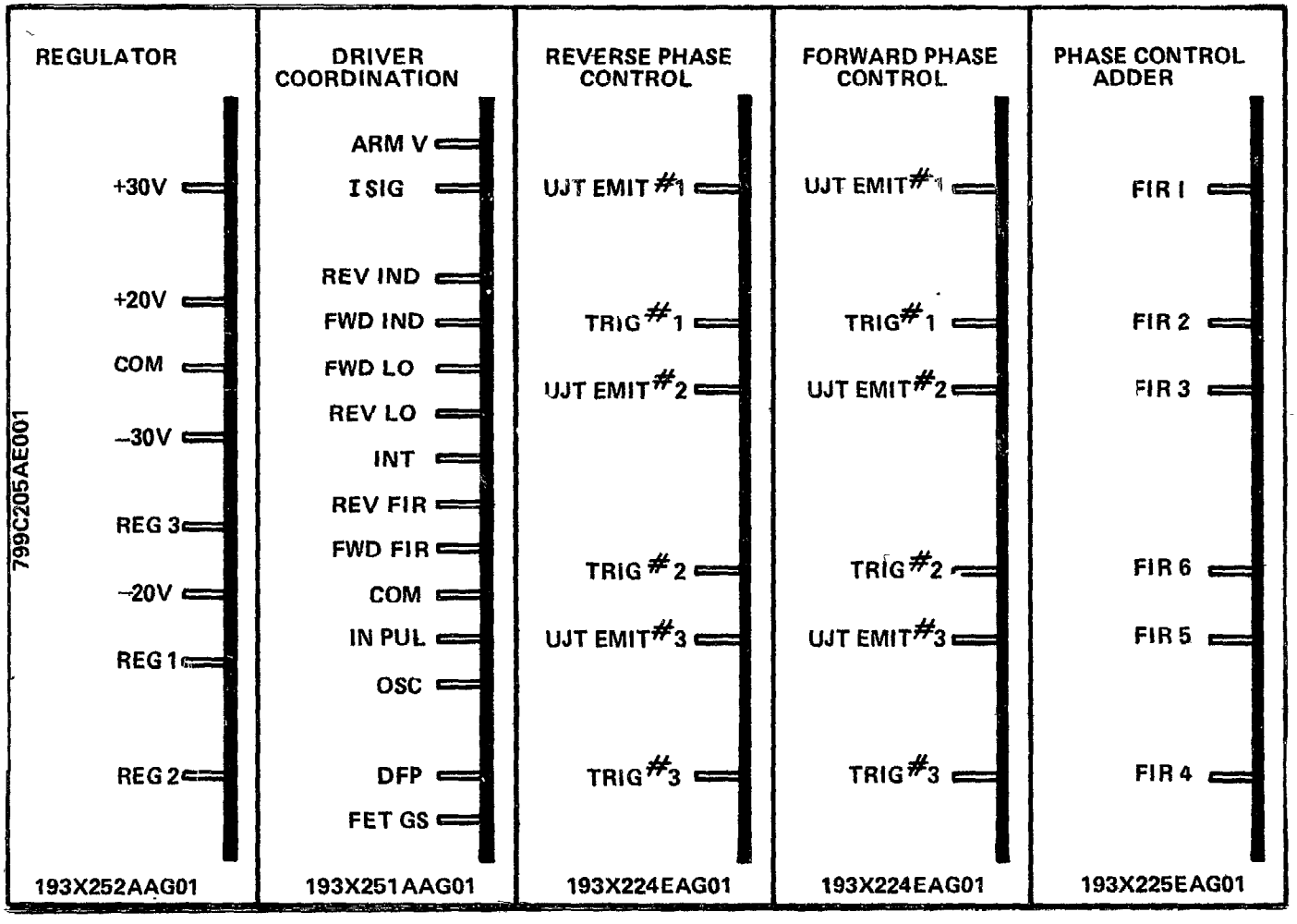


FIGURE 2-2 LOCATION AND FUNCTION OF DRIVER REGULATOR TEST RINGS

SECTION III
INSTALLATION

3.1 EQUIPMENT LOCATION

Speed Variator power units equipped with filters are suitable for most factory areas where other industrial equipment is installed. Locations subject to steam vapors or excess moisture, oil vapor or chemical fumes should be avoided. If your unit has a filter and blower system, the filters should be changed or cleaned before they become clogged. Power units should be installed in a well-ventilated area not subject to excessive heat. The Power and Control Circuit, plus transformer, are designed to operate in an ambient temperature range of 0°C to 55°C (+32°F to 131°F) maximum.

WARNING

EQUIPMENT SHOULD NEVER BE INSTALLED WHERE HAZARDOUS, INFLAMMABLE OR COMBUSTIBLE VAPORS OR DUSTS ARE PRESENT. SUFFICIENT CLEARANCE IN FRONT OF THE UNITS SHOULD BE ALLOWED FOR THE ACCESS OF MAINTENANCE OR REPAIR.

3.2 TOOLS REQUIRED

The normal electrical and mechanical tool boxes maintained in most factories are all that is required for the installation of this equipment.

3.3 MECHANICAL INSTALLATION

The mechanical installation will depend upon the type of mechanical enclosure supplied. If the equipment is supplied in an open panel for installation, this has been designed to be installed in a customer supplied enclosure. If the equipment supplied is mounted in a wall enclosure, install it as per outline drawings for wall enclosures. Floor mounted equipment enclosure should be mounted as per the outline for the floor mounted enclosure.

3.4 ELECTRICAL WIRING AND INTERCONNECTION

All external wiring shall be in accordance with the National Electrical Code and be consistent with all local codes. All internal electrical connections between components and the Speed Variator power units were made at the General Electric factory. When installing Speed Variators, all connections should be checked for tightness. Connections may become loose in shipping or storage. A diagram showing the connections between the power unit and the related components is furnished with each equipment. All terminals to which the external connections are to be made are numbered on the equipment as indicated on the interconnection diagram. It is recommended as each connection or wire is connected to the equipment that it be checked off on the interconnection diagram and verified by continuity tests. When motor tachometer leads are connected it is recommended that tachometer feedback wiring be a twisted pair with at least six turns per foot of length. Also the speed reference input leads should be twisted shielded pairs with the shield grounded at only the remote control end (not the drive). The current limiting resistor (CLR) is a dual range resistor; center tap to one end is .25 ohms and is used for BY490 motors with the end to end connection being .5 ohms for the BY470 motors.

WARNING

ALL MOTOR BASES AND EQUIPMENT ENCLOSURE HOUSINGS SHOULD BE CONNECTED TO THE FACTORY OR FACILITY EARTH GROUNDING SYSTEM.

NOTE

ON SOME SYSTEMS THE TRANSFORMER AND/OR CLR RESISTOR IS SHIPPED FOR SEPARATE MOUNTING AND MUST BE MOUNTED AND CONNECTED TO THE SYSTEM. THE BASIC DRIVE REQUIRES EXTERNAL 115VAC CONTROL POWER INPUT.

CAUTION

DO NOT USE POWER FACTOR CORRECTION CAPACITORS WITH THIS EQUIPMENT SINCE DAMAGE CAN RESULT FROM HIGH VOLTAGES GENERATED WHEN CAPACITORS ARE SWITCHED.

SECTION IV
CHECKOUT

4.1 GENERAL

This section is written in a step-by-step approach to start-up a DC-3032R drive system. If, during the course of startup and checkout, a step/indication cannot be performed, refer to Section VI, TROUBLESHOOTING, Table 6-1 or 6-2. These Troubleshooting tables are written to follow each startup step in sequence. Startup and checkout steps are cross-referenced to paragraph/step numbers and indications in the Troubleshooting tables. This section does not include instructions on special regulators or auxiliary functions which may be included in individual systems. These instructions would be detailed elsewhere in the instruction book or system drawings. Checkout will be divided into two parts; the first part will provide simplified startup and checkout procedures for the single axis drive. Part two contains the startup and checkout steps for the dual axis drive.

Part I Startup and Checkout for Single Axis Drive. (With Diagnostic Card or Portable Diagnostic Unit)

Using the diagnostic circuit (IDT), all checks may be made from in front of the regulator using the test reference potentiometer (TRP). External reference signals are not necessary until final system tests are made. Systems with remote auxiliary protective devices must be jumpered when they have normally closed contacts during system operation and when these contacts open they shut the drive down or stop the drive from being turned on. Any special input voltage that actuates relays are also required. (Refer to your System Elementary Diagram.) The following abbreviations will be used in this section for the diagnostic circuitry.

Switch #1	SW1
Switch #2	SW2
Switch Positions	
Up	Up
Center	Ctr
Down	Dn
Test Reference Potentiometer	TRP
TRP Direction	
Clockwise	CW
Counter-clockwise	CCW
DC Voltages Plus or Minus Signs	+ or -
Voltage Tolerance	± or + % or - %
AC Voltage	No ± sign except for tolerance
Volt Ohm Meter	VOM

WARNING

THE INTERNAL DRIVE CIRCUIT BREAKER DOES NOT DISCONNECT ALL POWER TO THIS DRIVE. PLACE EXTERNAL CIRCUIT BREAKER/DISCONNECT DEVICE TO OFF TO REMOVE ALL POWER TO THE DRIVE AND VERIFY POWER IS DISCONNECTED TO THE DRIVE BY MEASURING WITH A VOM AT THE INPUT TO THE INTERNAL DRIVE TERMINAL BOARD PTB (K1, K2 AND K3) AND 115VAC ON 1TB (1 AND 4).

4.2 TEST EQUIPMENT REQUIRED

This equipment has been designed so that only a volt ohm meter (VOM), oscilloscope, and tachometer are all that are required for the normal startup and checkout. Test equipment that may be required for auxiliary functions and devices for detailed troubleshooting are listed below:

Volt-ohm Meter (VOM) 3 ranges minimum
X1, X10, X100; 20,000 ohm per volt
d-c sensitivity
Oscilloscope (scope)
RPM Measuring Device (0 to 2,000RPM) Tach
DC type Ammeter - 0 to 300 amps,
adjustable ranges

NOTE

DURING CHECKOUT, RECORD MEASUREMENTS AND SETTINGS ON THE TEST DATA SHEET SUPPLIED, UNDER THE USER DATA COLUMN. TDS BESIDE A STEP INDICATES AN ENTRY ON THE TEST DATA SHEET.

4.3 POWER-OFF CONTINUITY TEST

WARNING

VERIFY THAT THE MAIN THREE-PHASE AC POWER INPUT TO THE SYSTEM EQUIPMENT IS DISCONNECTED OR SWITCHED OFF.

Perform a point-to-point continuity test for all newly installed wiring and interconnection. Continuity is defined as 1/2 ohm or less.

4.4 NO LOAD - POWER-ON TEST

WARNING

ELECTRIC SHOCK CAN CAUSE PERSONAL INJURY OR LOSS OF LIFE. WHETHER THE AC SUPPLY IS GROUNDED OR NOT, HIGH VOLTAGES TO GROUND WILL BE PRESENT AT MANY POINTS THROUGHOUT THE DRIVE.

No load testing is defined as the motor shaft disconnected from the end devices or no working load on the end devices.

4.4.1 TURN ON - INITIAL CHECKOUT

CAUTION

ALWAYS RETURN SPEED REFERENCE INPUT TO ZERO AND LET MOTOR COME TO A REST PRIOR TO CHANGING ANY DIAGNOSTIC SWITCH POSITIONS.

TDS a. Verify that a 3-phase a-c power input to the drive is of the proper value as listed on the equipment data nameplate (-5, +10%).

NOTE

WHEN USING PORTABLE IDT UNIT, THE PLUG MUST BE CONNECTED TO 6PL ON BACK OF UNIT DOOR AFTER THE PATCH PLUG HAS BEEN REMOVED.

b. Set TRP to zero, SW1 to Ctr, SW2 to Ctr; this disconnects power from SCR module (MA contacts open) and disconnects all reference and command inputs.

c. Apply main a-c power to the drive system (the a-c circuit breaker in the drive system must be switched on). The phase sequence indicator illuminates. This indicator being illuminated verifies:

1. That three phase power is applied and is in the proper phase sequence.

NOTE

IF THE INDICATOR ON THE POWER CONVERSION ASSEMBLY FAILS TO ILLUMINATE, INTERCHANGE ANY TWO TRANSFORMER INPUT PHASES ONCE: IF INDICATOR IS STILL OUT, PROCEED TO THE TROUBLE-SHOOTING TABLE 6-1.

TDS d. Check for motor field voltage (as per motor data nameplate) and that the field loss relay is energized (when CPE is supplied for shunt motor only).

4.4.2 STATIC TEST REGULATOR CARD

This part of the test checks the following functions of the Regulator Card with the SCR module disconnect (MA open) and using the Test Reference potentiometer for reference input.

Test reference input/output
Regulator card power supplies.

a. Verify TRP is set to 0 and SW1 is at Ctr. Place SW2 to Dn.

TDS b. With the VOM verify that +27V to +36V is measured between the +30V test ring and COM.

TDS c. With the VOM verify that +20V ±1 is measured between the +20V test ring and COM.

TDS d. With the VOM verify that -27V to -36V is measured between the -30V test ring and COM.

TDS e. With the VOM verify that -20V ± 1 is measured between the -20V test ring and COM.

TDS f. With the VOM monitoring REG1, turn the TRP fully CW and verify an increase in voltage (Check Test Data Sheet for exact value), still monitoring REG1 turn the TRP fully CCW and verify that an equal but opposite polarity voltage increase is measured.

TDS g. With the VOM monitoring REG2, verify that the voltages measured are approximately ±8V and equal but opposite in polarity to REG1 (CW is +, CCW is -).

4.4.3 STATIC TEST-DRIVER PORTION

This part of the test checks the following functions of the Driver Portion of the Driver Regulator with the SCR module disconnected (MA open), Regulator unity gain and with no current or voltage feedback signals.

Driver Coordination Card Signals
Reverse Phase Control Card Signals
Forward Phase Control Card Signals
Phase Control Adder Card Signals

a. Verify TRP is set to 0 and SW1 is at Ctr and SW2 is at Dn.

b. With the VOM monitoring the REV FIR test ring, slowly turn the TRP CCW until its fully CCW and the output will indicate from .5V up to +10V (+8V produces full speed).

c. With the VOM monitoring the FWD FIR test ring, slowly turn the TRP CW until its fully CW and the output will indicate from .5V to +10V (+8V produces full speed). Return TRP to 0.

TDS d. With the VOM monitoring the FWD LO test ring, turn the TRP slightly CCW. The VOM should indicate +10V minimum. Return the TRP to 0, VOM should indicate approximately 0.

TDS e. With the VOM monitoring the REV LO test ring turn the TRP slightly CW. The VOM should indicate +10V minimum. Return the TRP to 0, VOM should indicate approximately 0.

TDS f. With the VOM monitoring OSC test ring, verify that a minimum of +2V is measured.

g. With the VOM, check each UJT EMIT test ring by turning the TRP fully CW and CCW; the voltage will rise from approximately +4.5V (at TRP-0) to+7V , in one direction only. Turning TRP CW provides the +7V on the Forward Phase Control UJT EMIT's, CCW for the Reverse Card.

h. With the VOM, check each FIR test ring by turning the TRP fully CW and CCW; the voltage will rise from approximately +.6V to +1.5V, in one direction only.

4.4.4 SYSTEM VOLTAGE REGULATOR TEST

This part of the test checks the following functions using the TRP for the reference and operating the drive as a voltage regulator, not a speed regulator.

This test is normally used as a troubleshooting tool if the drive is not running properly. It also can be used to verify:

Proper armature voltage feedback
Proper current feedback
Proper amarature voltage
Motor direction and speed
Proper tachometer polarity

CAUTION

WHEN OPERATING DRIVE IN THE TEST OR MANUAL MODE, CONTINUALLY OBSERVE THE MACHINE TRAVEL TO AVOID HITTING THE ELECTRICAL AND/OR MECHANICAL LIMITS.

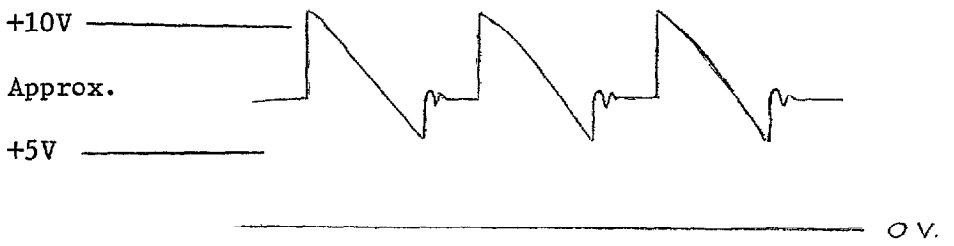
a. Verify the TRP is set to 0, place SW2 to Up and SW1 to Dn.

b. Verify the REG2 test ring is at 0V; if not, adjust TRP to 0V.

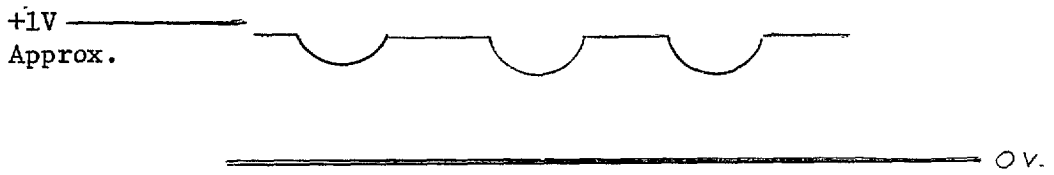
c. Using the scope (set to 2 millisec./CM and .5 V/CM) verify that the signal on "I SIG" test ring is as indicated below:

d. Using the scope (set to 2 millisec. /CM and 2V/CM) verify that the signal on "ARM V" test ring is as indicated below:

TDS e. Connect the VOM to measure -127V ±7V between PTB (DC1 and DC2) and with the scope monitoring "ARM V" test ring, slowly turn the TRP fully CCW and verify that the VOM indicates -127V ±7V and the scope display is as indicated below: Scope set at 5V/CM, 2 millisec./CM.



f. With the scope verify that the display on "INT" test ring (TRP still fully CCW) is as indicated below: Scope set at 1V/CM, 2 millisec./CM.



TDS g. Return the TRP to 0 and verify approximately 0V reading on the VOM. Reconnect the VOM to read the opposite polarity (+) on PTB (DC1 and 2) and slowly turn the TRP fully CW and verify a +127V ±7V reading. With the scope verify that "ARM V" test ring as displayed is approximately equal but of opposite polarity as pictured in step e.

h. With the scope verify that the display on "INT" test ring is approximately equal but of opposite polarity as pictured in step f.

TDS i. With TRP still fully CW check the tachometer input signal polarity and verify that the negative is connected to 1TB17 and the other lead to 1TB18. Tachometer voltage is 18 volts per thousand RPM ±10% for permanent magnet motors; 50/100 volts per thousand RPM ±10% for shunt wound motors.

TDS j. With a tachometer verify that the motor top speed, in both directions, is as listed on the motor data nameplate. If some lesser operating speed is required the "MAX SPEED" pot will be set for the desired application in the following paragraph.

4.4.5 SYSTEM SPEED REGULATION TEST (LOCAL CONTROL)

This part of the test checks the following functions using the TRP for the reference and operates the drive as a speed regulator.

Proper tachometer feedback level
Proper tachometer connection
Proper drive operation as a speed regulator

a. Verify the TRP is set to 0, SW1 is Dn and place SW2 to Ctr

CAUTION

WHEN OPERATING DRIVE IN THE TEST OR MANUAL MODE, CONTINUALLY OBSERVE THE MACHINE TRAVEL TO AVOID HITTING THE ELECTRICAL AND/OR MECHANICAL LIMITS.

b. Slowly turn the TRP CW and verify smooth motor response up to top speed in the "forward" direction (armature voltage is positive).

c. Quickly turn the TRP CCW and verify fast smooth motor response up to top speed in the opposite direction. Return TRP to 0 and verify motor steps.

4.4.6 NORMAL SYSTEM OPERATION (REMOTE CONTROL)

This part of the test checks the following functions with the system operating from its remote control equipment.

For systems that are controlled by tape input but have a local manual control as part of their system, they should be used first prior to operating in the automatic mode.

CAUTION

IF ANY JUMPERS WERE USED ON REMOTE AUXILIARY PROTECTIVE DEVICES BE SURE TO REMOVE THEM AT THIS POINT.

4.4.6 NORMAL SYSTEM OPERATION (Cont'd.)

Due to the many command/control input requirements used, the following "Turn-on and Checkout" subsection is written to functional test requirements, such as "Select Forward Direction", "Input Low Speed Reference Signal", "Close MA", or "Start/Stop Drive".

a. Verify the TRP set to 0, place SW1 to Up - "REMOTE (NORMAL)" and SW2 to CTR "NORMAL". Verify that the MA contactor actuated.

b. Select the Forward direction and slowly apply full Speed Reference. Check/Adjust the "MAX SPEED" potentiometer for the desired motor top speed.

c. Quickly reverse motor direction command and verify fast, smooth response of motor up to top speed.

NOTE

IF ERRATIC MOTOR OPERATION IS OBSERVED ANYWHERE THROUGH THE SPEED RANGE CHECK INPUT SPEED REFERENCE SIGNAL OR MOTOR TACHOMETER FEEDBACK SIGNAL FOR NOISE PICKUP, USING A SCOPE.

d. Operate Drive System in its remote automatic mode.

NOTE

IF ANY SYSTEM ABNORMALITIES OCCUR IN THIS PORTION OF THE TEST, THE PROBABLE CAUSE IS IN THE REMOTE CONTROL EQUIPMENT, DUE TO THE FACT THAT THE DRIVE SYSTEM HAS OPERATED PROPERLY AS A VOLTAGE REGULATOR/SPEED REGULATOR.

NOTE

WHEN PORTABLE IDT UNIT IS DISCONNECTED REPLACE PATCH PLUG.

PART II Startup and Checkout for Dual Axis Drive

To Be Supplied

SECTION V
MAINTENANCE

WARNING

ELECTRIC SHOCK CAN CAUSE PERSONAL INJURY OR LOSS OF LIFE. IF POWER OFF MAINTENANCE IS BEING PERFORMED, VERIFY ALL POWER TO THE DRIVE SYSTEM IS SWITCHED OFF OR DISCONNECTED. RECOMMEND POWER SWITCHES BE RED TAGGED DURING POWER OFF MAINTENANCE.

5.1 MECHANICAL

The mechanical maintenance required for the drive system is divided into two basic units; power unit and motor. The power units only mechanical maintenance is checking and changing the air filter (if supplied) as required.

Motor maintenance is covered by the motor instruction book supplied with the motor and should be followed in all cases.

5.2 ELECTRICAL

The electrical maintenance for the drive system is divided into a "Power OFF" and "Power ON" inspection procedure.

5.2.1 Power Off (every six months)

a. Check all electrical connections for tightness.
b. Look for signs of poor connections or overheating (arcing, discoloration).
c. Manually check cooling fans for easy rotation(if supplied).

5.2.2 Power On

WARNING

ELECTRIC SHOCK CAN CAUSE PERSONAL INJURY OR LOSS OF LIFE.

5.2 ELECTRICAL (Cont'd.)

a. Power on (Every month)
With drive system operating at top speed (full input reference), measure and record the voltage feedback signal on ARM V and Regulator "Common". The recorded measurement should be within 0.2 volts of the initial measurement recorded during installation and test of the equipment. If the measurement difference is greater than 0.2 volts DC, refer to Section VI.

b. Power On (Every six months)
With the drive system operating, measure/record and compare the following functions with previous test data. If any significant differences are noted, re-adjustment or replacement may be in order. Refer to the appropriate step in Section IV for test/adjustment.

1. +20VDC
2. -20VDC
3. REG2 Reference Input, Forward/ Reverse Maximum
4. Firing Pulses, 1 thru 6
5. UJT, EMIT, 1, 2 and 3
6. Current Feedback
7. Top Speed (RPM) Forward-Reverse

5.2.3 Spare Cards

It is recommended that on hand spare cards be put in place of original cards every six months.

5.3 SUBASSEMBLY/ASSEMBLY REPLACEMENT PROCEDURES

In the event of an assembly or subassembly failure the following steps are required for replacement of certain assemblies/subassemblies and printed circuit boards/cards.

WARNING

THE INTERNAL DRIVE CIRCUIT BREAKER DOES NOT DISCONNECT ALL POWER TO THIS DRIVE. PLACE EXTERNAL CIRCUIT BREAKER/DISCONNECT DEVICE TO OFF TO REMOVE ALL POWER TO THE DRIVE AND VERIFY POWER IS DISCONNECTED TO THE DRIVE BY MEASURING WITH A VOM AT THE INPUT TO THE INTERNAL DRIVE TERMINAL BOARD PTB (K1, K2 AND K3) AND 115VAC ON 1TB (1 AND 4).

5.3.1 Power Conversion Module

a. Open the module door and disconnect power wire terminal lugs T1, T2 and T3 from the heatsink connection studs.

b. Disconnect power wire terminal lug P1 from the conversion assembly connection stud.

c. Unplug connectors 1PL and 2PL from the power conversion module.

d. Loosen the four mounting nuts from the main panel mounting studs and slide the power conversion assembly up, tilt slightly forward, and lift out.

5.3.2 Synchronizing Transformer Assembly (STA)

a. Remove the power conversion assembly as described in paragraph 5.3.1.

b. Unplug 5PL on back of unit's front door and disconnect input wires on STA terminals A4/B1, A1 and B4/C1.

c. Remove the four mounting nuts and washers from the side panel studs and lift out STA assembly.

5.3.3 MA Contactor (behind circuit breaker)

a. Disconnect wires K1, K2 and K3 at the circuit breaker.

b. Remove the three nuts and washers from the back main panel mounting studs and swing circuit breaker assembly to the right to gain access to the MA contactor.

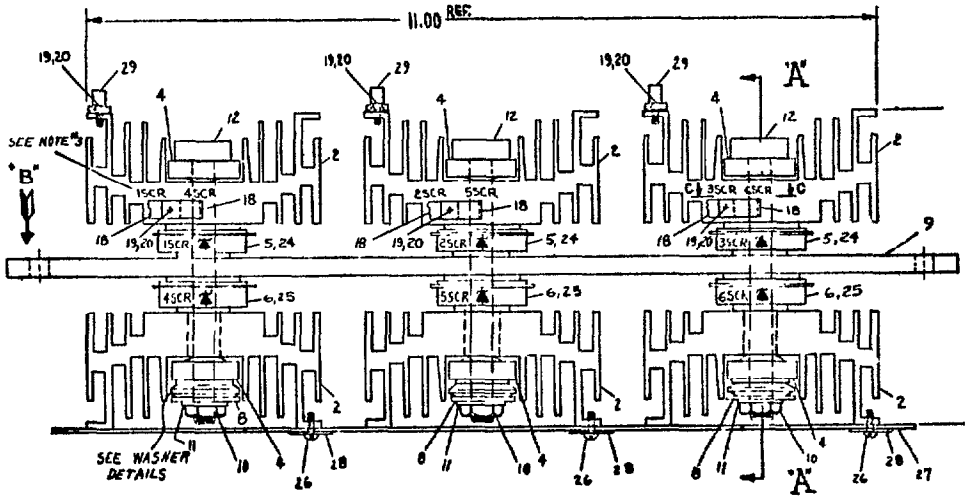
5.4 SCR OR RECTIFIER REPLACEMENT PROCEDURE

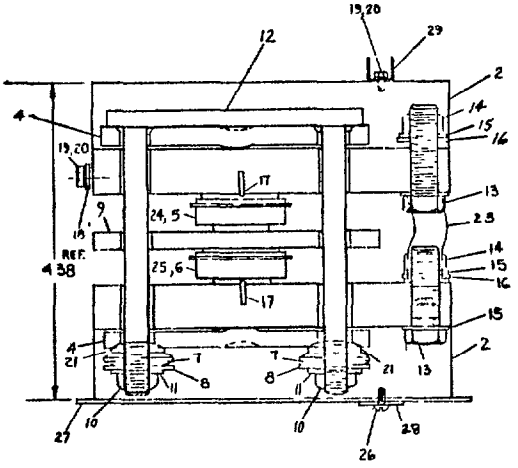
In the event of an SCR cell failure the following steps are required for replacement of the press pak cell on the heatsink assembly.

If minimized down time is a critical factor, it is recommended that a complete Power Conversion Module (one module consisting of six SCR's with heatsinks, pulse transformer card, current isolator and suppression card, mounted in the sheet metal enclosure) be an "on the shelf" spare.

5.4.1 Power Conversion Module Assembly

a. Place the assembly with the hinged door facing down and remove the three nylon screws and washers holding the back insulation cover (parts 26, 27 and 28). Reference heatsink pictorial for parts location and identification.





PART	NAME	PART	NAME
1	ASM	16	WASHER
2	HEAT SINK	17	ROLL PIN
3	HEAT SINK	18	CLAMP
4	SUPT PLATE (FULCRUM)	19	SCREW
5	SCR	20	WASHER
6	SCR	21	WASHER
7	ASM WASHER	22	(DELETED)
8	PLATE	23	CONNECTOR
9	BUS BAR	24	SCR
10	NUT	25	SCR
11	WASHER	26	SCREW-NYLON
12	FASTENER (TIE ROD)	27	INSUL COVER
13	SCREW	28	WASHER
14	NUT	29	TERM FASTON
15	LOCK WASHER		

SECTION VI
TROUBLESHOOTING

6.1 GENERAL

These troubleshooting procedures assume that the system has been installed and checked out and has been operating properly prior to a malfunction. Fast efficient troubleshooting of the drive system is based on a thorough knowledge of the theory of operation plus well kept maintenance records that will provide trend data indicating the possible area of the problem. All measurements should be compared with checkout values. If temporary malfunctions/problems occur, then seem to disappear or self-correct themselves, then the incoming three phase a-c power should be checked for proper amplitude and phase at times of peak loading in the facility/building. Should repeated circuit breaker trip and/or SCR failures occur, the three phase a-c input power should be checked for high level spikes or extreme short duration power variations. During troubleshooting when a card or subassembly is found or suspected of being bad, it is recommended that prior to replacing the card/subassembly the inputs be checked for proper values. This will exclude the chance of further damage to the replacement item due to causes beyond the suspected item. If line fuses or SCR's have failed, it is recommended that the power conversion module be disconnected by placing SW1 to Ctr, and the system test, Section IV, be used to check for proper operation prior to connecting up the power conversion module after failed components are replaced and power is reapplied.

6.1.1 ELECTRICAL

The electrical troubleshooting procedures are divided into two parts; Drive System operating but not properly and Drive System not operating. The following checklist will help locate the malfunction with a minimum of effort when a logical approach/analsis of the problem is considered. If in troubleshooting, the inputs are found to be good but the outputs are bad, then the malfunction is assumed to be located. To use the checklist correctly, first select the proper checklist depending on the type malfunction indicated - Operating or Not Operating. Using this checklist, locate the type of malfunction indicated

under the left-hand column, "Indication". The right-hand column "Check/Adjust/Replace" lists, in logical order, the steps to be taken. When a step or action is completed and the malfunction still occurs, proceed to the next step. If the step located the problem area, troubleshoot, isolate and correct the malfunction. Retune/Adjust as required using Section IV.

NOTICE

POWER UNIT 2TB TERMINAL BOARD CUSTOM SELECTED COMPONENTS FOR THIS SPECIFIC DRIVE.

C1 ..... TACHOMETER LEAD CAPACITOR
R1,R2 .. TACHOMETER FEEDBACK SCALING (.75ma)
R3 ..... GAIN (RESPONSE)
R4 ..... ACCELERATION RATE
R5,C2 .. STABILITY

CONSULT THE FACTORY BEFORE ATTEMPTING TO CHANGE ANY OF THE ABOVE COMPONENT VALUES.

5.4.1 Continued

b. Remove the associated SCR leads cable from the cable clamp for the failed cell (parts 18, 19 and 20).

c. Remove the associated SCR suppression lead spade connection from the heatsink assembly stab-on (part 29).

d. Remove the associated SCR gate (white) and cathode (red) twisted leads with spade connectors from the stab-on at the back of the associated terminal board.

e. SCR Cell Replacement

1. Place heatsink assembly with green tie rods (Fastener part 12) facing down and remove the nuts (two only) of the failed cell subassembly (part 10). This allows the tie rod to slip down to rest on the working surface.

2. Remove the failed cell and clean the heatsink surface with a soft cloth and inspect the surface to make sure it is smooth.

3. Take the new replacement cell, twist the cell leads together, place white tubing over twisted cell leads and crimp on the female spade terminals and apply a small amount of "Burndy Penetrox A" (or equivalent joint compound) to the small hole on each side of the cell (with a dab on top) so that under pressure the compound will cover only the raised center circular surface on each side.

4. Place new cell in the same orientation as the failed cell and place on the roll pin (part 17) of the heatsink so the roll pin is in the center hole of the cell.

5. Place the two nuts (part 10) back on the tie rod (with parts 21, 7, 8 and 11 on the tie rod as indicated) and tighten each nut finger tight so the threads showing are approximately the same on both sides.

6. Check that both cell holes are still over the roll pins.

7. With the nuts finger tight, use a wrench and tighten each nut 1/6th of a turn (alternate between nuts) until the nuts have completed 1-5/6 turns each. Inspect the assembly to make sure that the heatsinks are aligned equally and parallel with each other and the center bus.

TABLE 6-1 DRIVE SYSTEM NOT OPERATING

INDICATION	CHECK/ADJUST/REPLACE
Phase sequence indicator not illuminated (4.4.1c)	1. External Power Applied. 2. Internal Circuit Breaker Switched On. 3. Damaged Light. 4. Faulty Socket (2PL). 5. Faulty Wiring.
No voltage or improper level (4.4.2b)	1. Check input voltage to drive. 2. STA transformer secondary to COM, 21 to 27VAC (STA Terminals A7, A8, B7, B8, C7 and C8 to COM). 3. Check continuity card pins to STA (See elementary or connection diagram). 4. Replace Card.
No voltage or improper level (4.4.2c)	1. Remove power and measure resistance at 2TB35 to Common. Should be in excess of 200 ohms. 2. Replace Card.
No voltage or improper level (4.4.2d)	1. Check input voltage to drive. 2. STA transformer secondary to COM, 21 to 27VAC (STA Terminals A7, A8, B7, B8, C7 and C8 to COM). 3. Check continuity card pins to STA (See elementary or connection diagram). 4. Replace Card.
No voltage or improper level (4.4.2e)	1. Remove power and measure resistance at 2TB35 to Common Should be in excess of 200 ohms. 2. Replace Card.
No voltage or low voltage at REG1 (4.4.2f)	1. Check diagnostic card switch settings. 2. TRP not fully CW or CCW. 3. +20 volts at IDT(S) to com., and -20 volts at IDT(C) to com. check wiring if no voltage. 4. Approximately 8.5 volts at IDT(K) to com. Replace IDT Card if no voltage. 5. Check wiring/inputs to regulator card. If wiring/input OK, replace regulator card.
No voltage or low voltage at REG2 (4.4.2g)	1. Check wiring/inputs. 2. Replace Card.

TABLE 6-1 DRIVE SYSTEM NOT OPERATING

INDICATION	CHECK/ADJUST/REPLACE
No voltage or low voltage (4.4.3b)	1. Check wiring/inputs. 2. Replace card.
No voltage or low voltage (4.4.3c)	1. Replace Card.
No voltage or low voltage (4.4.3d)	1. Replace Card.
No voltage or low voltage (4.4.3e)	1. Replace Card.
No voltage or low voltage (4.4.3f)	1. Check wiring/inputs. 2. Replace Card.
No voltage or low voltage (4.4.3g)	1. Check wiring/inputs. 2. Replace Card.
No voltage or low voltage (4.4.3h)	1. Check wiring/inputs. 2. Replace Card.
Improper or missing signal on I SIG (4.4.4c)	1. Check REG2 for 0 volts output. 2. Check wiring/inputs to the card. 3. Replace Card.
Improper or missing signal on ARM V (4.4.4d)	1. Check REG2 for 0 volts output. 2. Check wiring/inputs to the card. 3. Replace Card.
No armature voltage or low armature voltage (4.4.4e)	1. Improper IDT switch position. 2. MA contactor not energized. 3. TRP not fully CW or CCW. 4. Replace Driver Coordination Card. 5. Replace the Forward or Reverse Phase Control Card depending on direction of failure.
Improper scope display (4.4.4f)	1. Replace Driver Coordination Card. 2. Replace the Forward or Reverse Phase Control Card depending on direction of failure.

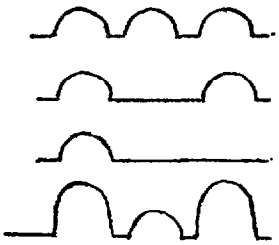
TABLE 6-2 DRIVE SYSTEM OPERATING

INDICATION	CHECK/ADJUST/REPLACE
Circuit Breaker Trips	1. Check motor/machine for binding or overload. 2. Reset circuit breaker and run motor/machine at low speed. 3. Check current feedback signal (I SIG). 4. Increase motor speed momentarily. 5. Reverse motor direction while observing I SIG for 3 equal amplitude pulses. 6. Check for severe line notching/ringing or marginal SCR and faulty suppression card. 7. Low line voltage (210VAC or less line to line) during regeneration. 8. Perform Driver Regulator signal check.
Cannot reach top speed	1. Check line voltage. 2. Check armature voltage with full reference applied. a. Voltage normal or low: 1. Check speed reference input. 2. Readjust Maximum Speed pot. 3. Check tachometer input voltage. 4. Check on 2TB7 to 18 for shorted C1. 5. Check Driver Regulator Signals 3. Replace Pre-amplifier card.
Overspeed	1. Check ARM V and Armature Voltage. 2. Check for demagnetization if PM motor. 3. Check Maximum Speed setting. 4. Check input and output of Regulator card. 5. Check field circuit (when supplied).
Motor Runaway	1. Check Motor Field leads for continuity (if supplied). 2. Check tach feedback voltage by setting IDT to operate as a voltage regulator. 3. Check field loss relay circuit (if used).
System does not respond to command	
A. Drive will not respond to a change in direction command	1. Check for proper reference input. 2. Check direction circuit selected. 3. Check for outputs at: a. Regulator references. b. Driver Coordination output. c. FWD LO and REV LO.

TABLE 6-2 DRIVE TROUBLESHOOTING

INDICATION	CHECK/ADJUST/REPLACE
Motor/Machine unstable/erratic	1. Check three phase AC input power. 2. Check outputs for 60hz noise. 3. Run drive with IDT set to operate system as a voltage regulator. If drive is still erratic, replace regulator driver coordination or phase control card. 4. Check speed reference input for noise pickup (with speed). 5. Check tach feedback signal for noise. 6. Check current feedback signal for noise. NOTE THE FOLLOWING LEADS SHOULD BE TWISTED PAIRS: REFERENCE INPUT, TACH AND CURRENT FEEDBACKS. 7. Check components and connections on 2TB1 thru 17 and 12 thru 18. 8. Using the scope, check for noise on the following test rings: a. REG2 (exclude tach noise). b. Driver Coordination output c. Common. d. Lockouts 1 and 2. e. ±20VDC. 9. Using the scope, check the following signals for proper width and time relationship to each other. For waveshapes refer to Table 6-3. a. UJT EMIT's b. TRIG's c. FIR #1, 2 and 3 or 4, 5 and 6.

TABLE 6-2 DRIVE SYSTEM OPERATING

INDICATION	CHECK/ADJUST/REPLACE
Motor/Machine unstable/erratic (Cont'd.)	10. Uncouple motor from load/machine and recheck for instability/erratic operation of motor. a. Check Circuit Breaker. b. Check power supplies and I SIG. c. Check overload relay (OLD). (if supplied) d. Check any external/auxiliary protective devices. e. Check X0 lead on isolation transformer for continuity. f. Check for proper input reference. g. Check motor blower motor for correct rotation/operation.
SCR not firing/ conducting.	Check for the following signals using a scope: 1. Verify that all three current feedback pulses (per direction) are present and of equal amplitude on I SIG as indicated below:  proper SCR firing. one SCR not firing. two SCR's not firing. unbalanced firing. 2. With Test Switch #1 in Down position and Test Switch #2 in Up position, verify that Firing Signals are present on the output of each Pulse Transformer card on the SCR module (white wire gate - red scope probe common).

Test Ring Voltage/Waveshapes

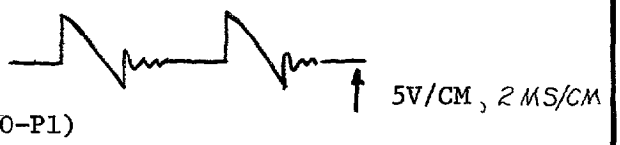
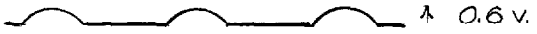
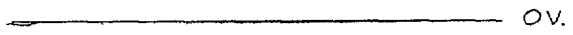
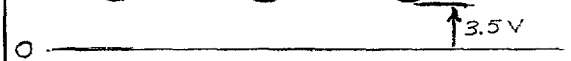
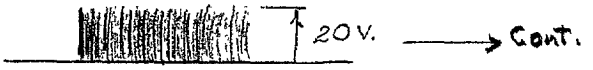
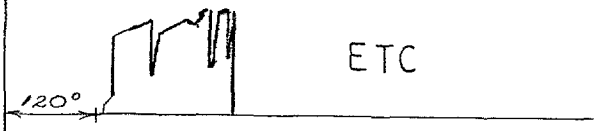
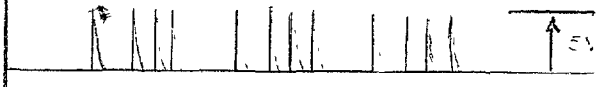
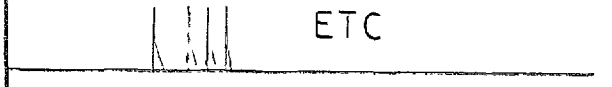
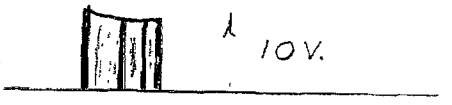
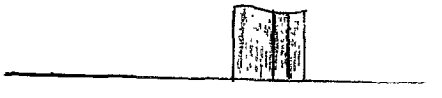
INDICATION	VOM	CHECK SCOPE TRP FULLY CW, SW1 Dn, SW2 Ctr.
Regulator Card Test Rings --		
+30V DC	+27 to +36	None
+20V DC	+20 ±1V	None
COM		
-30V DC	-27 to -36	None
REG3	0V	None
-20V DC	-20 ±1V	None
REG1	-4V Min	None
REG2	+8V Min	None
Driver Coordination Card Test Rings		
ARM V	+127V ±7V PTBDC2-DC1	 (XO-P1)
I SIG	+.16 Min	
REV IND	0V	
FWD IND	+.6 Min	
FWD LO	0V	
REV LO	+10V	
INT	-.65V Min	
REV FIR	-.57V Min	
FWD FIR	+3.1V Min	
COM		
IN PUL	+.03V Min	
OSC	2V Min	
DFP	+26V Min	
FET GS	0V	NOTE: TRP fully CCW, IN PUL. OSC. DFP, FETGS are the same, all others inverted.

TABLE 6-3 DRIVER REGULATOR

Test Ring Voltage/Waveshapes

INDICATION	VOM	CHECK, SCOPE
Forward Phase Control		
UJT EMIT #1	+7V min. (Off +4.5V)	
UJT EMIT #2		
UJT EMIT #3		
TRIG #1		
TRIG #2		
TRIG #3		
Phase Control Adder		
FIR #1	Off +.6V approx.	
FIR #2		
FIR #3		
FIR #6	On +1.5V min.	
FIR #5		
FIR #4		

SECTION VII
SPARE PARTS RECOMMENDATION

7.1 GENERAL

A realistic "on hand" spares stock coupled with the Speed Variator low cost card exchange plan will lead to faster resolution of down time of the equipment in case of malfunction. By having on hand spare parts, there is no extended down time after the problem has been located awaiting parts that must be ordered and shipped from the factory. The concept of easily removable (plug in) printed circuit boards is a fallacy if it only takes a few minutes to discover the defective assembly but hours to order and procure a replacement. Therefore, from the standpoint of keeping the equipment/machine operating with a minimum of down time, readily available on hand spares are a must. The advantages coupled with the "Card Exchange Plan" are three fold:

1. Minimum down time, waiting time for part arrival is eliminated.
2. The lower cost of the "Card Exchange Plan".
3. No cost for time and special test equipment to troubleshoot, repair and test defective cards. The repair and testing of printed circuit cards takes special handling techniques and test equipment that most facilities do not have.

The proper evaluation of profits lost per hour of down time of the machine/system versus the cost of on-hand spare parts and the time saved is a readily available figure. A high volume machine output would therefore require a larger spare parts stock to insure minimum down time. For further information on the Speed Variator Products Department Card Exchange Plan, contact your local General Electric Company Installation and Service Engineering Component or your District Sales Representative or Speed Variator Products Department, Erie, Pennsylvania.

7.2 RECOMMENDED SPARE ASSEMBLIES, SUB-ASSEMBLIES AND PRINTED CIRCUIT CARD/BOARDS.

NOTE

WHEN ORDERING SPARE PARTS
BE SURE TO GIVE COMPLETE
PART NUMBER, AND ASSEMBLY
NAME TO INSURE FAST AND
EFFICIENT SERVICE.

The following is a list of recommended spare parts.

Assembly/Sub-assembly	Quantity
Regulator Card	1
Driver Coordination Card	1
Power Conversion Module	1
Phase Control	1
Control Adder	1

7.3 RECOMMENDED SPARE COMPONENTS

Component	Quantity
Command/Control Relays (small/plug-in)	1 of each type

NOTE

ALL MOTOR SPARE PARTS AS PER RECOMMENDATION OF THE DC MOTORS INSTRUCTION BOOK INCLUDED IN THE DOCUMENTATION SUPPLIED SHOULD BE ON HAND.

SECTION VIII
DOCUMENTATION/DRAWINGS FURNISHED

8.1 GENERAL

The following types of documentation/drawings are normally supplied with your variable speed drive to aid in the installation and operation of your system. For the exact list of documentation/drawings supplied, see the "List of Equipment" sheets in the data package.

8.1.1 Documentation

a. Instruction Manual
b. Direct Current Motors and Generators Instruction
c. Control Devices Instructions/Bulletin (if applicable)
d. Printed Circuit Card Interchangeability List

8.1.2 Drawings/Prints

8.1.2.1 DC Motors

a. Connection Diagram
b. Outline

8.1.3 Power Unit

a. System Elementary Diagram
b. System Connection Diagram
c. Interconnection Diagram (if applicable)
d. Elementary Diagram, Driver Regulator
e. Connection Diagram, Driver Regulator

8.1.4 Auxiliary/Special Devices Diagram

DC-3032R
FEED DRIVE SYSTEM
(Single Axis Unit)

Appendix to GEK-22956 for 50hz operation

To convert a 60hz base input frequency Feed Drive power unit to operate on a 50hz base input frequency, the following must be done:

1. A 50hz isolation transformer must be supplied.

2. Remove the metal jumper from 2TB25 to 2TB26.

3. Add a 100K ohm resistor (1/2 watt min., 1% preferred) from 2TB25 to 2TB35.

4. Move the three wire jumpers (per card) to the 50hz stab-on posts on the Forward and Reverse Phase Control cards.

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY
SPEED VARIATOR PRODUCTS DEPARTMENT
ERIE, PENNSYLVANIA 16501 SVPD